



National Transportation Safety Board Aviation Accident Final Report

Location:	Hamilton Township, NJ	Accident Number:	ERA13FA424
Date & Time:	09/20/2013, 1651 EDT	Registration:	N174BK
Aircraft:	BROWN ROBERT K RV7A	Aircraft Damage:	Destroyed
Defining Event:	Loss of control in flight	Injuries:	1 Fatal
Flight Conducted Under:	Part 91: General Aviation - Personal		

Analysis

After taking off, the pilot climbed the experimental amateur-built airplane to 6,500 feet mean sea level in visual meteorological conditions; the airplane remained in level flight for about 13 minutes and was traveling about 130 knots indicated airspeed. The airplane then suddenly lost about 3500 feet in altitude, accelerated to about 220 knots, and reversed direction within a 10 second period. Moments later, the airplane was observed traveling in a northwesterly direction at a low altitude, almost completely upside down at one point, with pieces of the airplane falling to the ground. Recorded radar data revealed that the airplane had entered a steep descending and accelerating left turn, and portions of the empennage separated from the airplane. The airplane continued on a descending, turning flight path until it impacted terrain. A postimpact fire ensued.

The wreckage path was about 1/2-mile long and contained three distinct areas of debris. The first area contained the lower half of the rudder. The second area contained the vertical stabilizer, the rudder balance weight, the left horizontal stabilizer, the left elevator, the left wingtip, the left elevator balance weight, and the cockpit canopy—all of which had separated from their mounting locations. The third area contained the main wreckage (the fuselage, engine, and wings), which struck the top of a tree, fell to the ground, and came to rest inverted. Examination of the wreckage revealed no evidence of an inflight fire, explosion, flight control failure, bird strike, or any preexisting structural anomaly.

Review of the airplane's design revealed that at an aerobatic gross weight of 1,600 pounds, the airplane complied with the +6/-3G standards of the FAA's aerobatic category. It had a maximum maneuvering speed of 124 knots and a never exceed speed of 200 knots. At the time of the inflight breakup, the airplane was traveling 20 knots above the published never exceed speed.

A friend of the pilot noted that he had seen the pilot recover after falling out of a maneuver at low altitude before, and that it was not uncommon for the pilot to sometimes fall out of a maneuver (loop and/or roll). Review of a video taken by his friend revealed that, during that flight, the pilot performed a left roll. During that maneuver, the pilot allowed the nose to drop

and the airplane lost approximately 1,000 feet of altitude.

The accident airplane’s abrupt and sudden maneuvering, which exceeded its design limitations, is consistent with the pilot’s loss of control after attempting an aerobatic maneuver.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's improper aerobatic maneuver that resulted in a loss of control, exceedance of the airplane's design limitations, and a subsequent in-flight breakup of the airplane.

Findings

Aircraft

Airspeed - Capability exceeded (Cause)

Personnel issues

Incorrect action performance - Pilot (Cause)

Factual Information

HISTORY OF FLIGHT

On September 20, 2013, about 1651 eastern daylight time, an experimental amateur built Vans RV-7A, N174BK, was destroyed during an inflight breakup and impact with terrain after a rapid loss of altitude and increase in airspeed near the Township of Hamilton, New Jersey. The private pilot was fatally injured. Visual meteorological conditions prevailed for the local personal flight conducted under Title 14 Code of Federal Regulations (CFR) Part 91, which departed Cross Keys Airport (17N), Cross Keys, New Jersey about 1640.

According to radar data provided by the Federal Aviation Administration (FAA), the airplane departed 17N at approximately 1640. Turn to an approximate magnetic heading of 120 degrees and climb to an altitude of 6,500 feet above mean sea level (msl). Approximately 13 minutes later, the airplane turned right to a southeasterly heading. It then rapidly lost altitude while reversing direction before descending through 300 feet msl where it was lost from radar as it descended below the floor of radar coverage.

According to witnesses, moments later the airplane was observed traveling in a northwesterly direction at low altitude, almost completely upside down at one point, and "pieces" of the airplane were observed falling to the ground. It then impacted in a wooded area and a fire ensued

PERSONNEL INFORMATION

According to NTSB records, the pilot had been involved in a previous accident in the Township of Hamilton, New Jersey (NYCo8CA042) on November 21, 2007, while flying a Cessna 172N, N172MG when the engine sputtered while in cruise flight and stopped producing power. The pilot then performed a forced landing to trees, resulting in substantial damage. Neither he nor his two passengers were injured. Examination of the fuel tanks by a FAA inspector revealed they were intact, and no evidence of fuel, fuel spillage, or fuel odor was identified at the scene. The pilot stated that he departed his home airport with full tanks earlier in the day and recorded 3.2 hours on the Hobbs meter. Several stops were made during the day, which involved six takeoffs and climbs to altitude. The Safety Board determined that the probable cause of that accident was the pilot's inadequate fuel consumption calculations which resulted in fuel exhaustion.

According to FAA records, the pilot held a private pilot certificate with ratings for airplane single-engine land. His most recent FAA second-class medical certificate was issued on July 11, 2013. He reported that he had accrued approximately 400 hours of total flight experience on that date, 85 hours of which was in the previous six months.

AIRCRAFT INFORMATION

The accident aircraft was a tricycle landing gear equipped, two seat, low wing airplane of conventional metal construction. It was equipped with a Superior Air Parts IO-360-B1AA3, horizontally opposed, 4-cylinder, air cooled engine which produced 180 horsepower, and a MTV-A5-B, three bladed constant speed MT-Propeller.

The airplane had not been built by the pilot but had been built by a previous owner.

At an aerobatic gross weight of 1,600 pounds, the airplane complied with the +6/-3G standards

of the FAA's aerobatic category. It had a maximum maneuvering speed of 142 mph (124 knots), and a never exceed speed of 230 mph (200 knots).

The maximum maneuvering speed of 142 mph (124 knots) was the maximum permissible speed at which full and abrupt control inputs could be applied. Any speed in excess of the maximum maneuvering speed with full control application could result in G-loads in excess of design limits.

The never exceed speed of 230 mph (200 knots) was the maximum permissible speed under any condition. Any speed in excess of this could result in structural damage. Full control application at the never exceed speed would produce a load of approximately +15.0 G.

According to FAA and maintenance records, the airplane had received its special airworthiness certificate on June 6, 2006. The airplane was purchased by the pilot on March 27, 2011.

The airplane's most recent conditional inspection was completed on March 15, 2013. Shortly afterwards, the rudder on the airplane was damaged while the airplane was tied down on a parking ramp when the rudder came into contact with a rudder stop which punctured the right lower, side of the rudder. The damaged rudder was removed by the owner and reskinned in accordance with FAA Advisory Circular 43.13-1B and Van's Aircraft design drawings, and was returned to service on April 18, 2013.

At the time of the accident, the airplane had accrued approximately 461 total hours of operation.

METEOROLOGICAL INFORMATION

The recorded weather at Atlantic City International Airport (ACY), Atlantic City, New Jersey, located approximately 6 nautical miles southeast of the accident site, at 1654, included: winds 200 degrees at 9 knots, visibility 10 miles; clear skies, temperature 22 degrees C, dew point 14 degrees C, and an altimeter setting of 30.05 inches of mercury.

Visual meteorological conditions prevailed along the route of flight and atmospheric data for use in determining the upper air profile in the area of the accident site was gathered on behalf of the NTSB by the United States Army Aberdeen Test Center from a high resolution weather forecast model (4DWx), developed by the National Center for Atmospheric Research (NCAR) that the Army Test and Evaluation Center (ATEC) Meteorology Teams use on a daily basis.

The model continuously merges data gathered from the Army's ranges as well as from sources such as FAA aircraft reports, air traffic control radar, satellites, National Weather Service weather radar, and upper-air and surface observations. Since data continues to be assimilated, when a new forecast is being developed, 4DWx "compares" its previous forecast with the observations and adjusts or "nudges" its forecast towards the observations. So, although the data provided by the program was model data, it included observations to produce and interpolate the upper air profile over a given point.

This data was generated from an altitude of 10,504 feet msl down to 66 feet msl at a point above the geographic location of the accident site. This data along with recorded radar data, and airplane characteristics, was later used to develop an airplane performance history for the accident and indicated that at 1700, at the airplanes initial maneuvering altitude of 6,500 feet, the weather conditions included: winds 125 degrees at 3 knots, temperature 10 degrees C, and a barometric pressure of 23.64 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

Examination of the wreckage path revealed that it was approximately 1/2 mile long and contained three distinct areas of debris.

The first area contained the lower half of the rudder.

The second area contained numerous pieces all of which were separated from their mounting locations. This included the vertical stabilizer (which was found in the top of a tree), the rudder balance weight, the left horizontal stabilizer, the left elevator, the left wingtip, the left elevator balance weight, and the cockpit canopy.

The third area contained the main wreckage (the fuselage, engine, and wings), which had remained attached to each other until striking the top of a tree, falling to the forest floor and coming to rest inverted, where they were further damaged by exposure to a postcrash fire.

Examination of the debris fields and main wreckage revealed no evidence of an inflight fire, explosion, or bird strike, and all of the major components of the airplane were recovered.

After collection and examination of the flight control system components, control continuity was established from the flight controls in the cockpit to the breaks in the system which displayed evidence of tensile overload and from the breaks in the system to the flight control surfaces.

Examination of the cockpit revealed that both magneto switches were in the on position, the alternator/battery master switch was on, the Automatic Packet Reporting System (APRS) Switch was on, the throttle was full forward, the propeller control was in the fine pitch/high rpm position, the mixture was full rich, and the wing flaps were in the up (zero degree) position.

Examination of the engine did not reveal any evidence of any preimpact malfunction or failure. The propeller hub had separated from the crankshaft during the impact sequence and the face of the fracture on the crankshaft flange displayed a 45-degree cupped shear lip and evidence of torsional rotation.

One propeller blade had remained attached to the hub, and the other had separated from its mounting location. Both propeller blades displayed leading edge gouging and chordwise scratching, and the separated blade also displayed S-bending. The propeller governor was impact damaged but remained attached to the engine.

Drive train continuity was established from the back of the engine to the front of the engine, and all of the valves were observed to be functional.

Oil was present in the rocker boxes and in the galleries of the engine. The oil pump displayed impact damage but could be operated by hand. Examination of the inside of the oil filter revealed no evidence of debris.

The engine driven fuel pump was functional and the fuel manifold valve contained trace amounts of fuel. The throttle body injector was intact, its throat was unobstructed, and the diaphragm assembly was undamaged.

The electronic magnetos were still attached to the engine however they were fire damaged and were unable to be operated. The electrodes on all of the spark plugs were intact, and appeared normal and gray in color with the exception of the No. 4 cylinder's top spark plug which was oil

fouled and the No. 4 cylinder's bottom sparkplug which was fire damaged.

The fractured pieces of the empennage and aft fuselage were examined on scene without any evidence of prebreakup or preexisting damage being discovered. They were later reexamined as part of a structures study.

MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy was performed on the pilot by the State of New Jersey, Office of the State Medical Examiner. Cause of death was multiple blunt injuries.

Toxicological testing of the pilot was conducted at the FAA Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma. The specimens were negative for carbon monoxide, cyanide, basic, acidic, and neutral drugs.

TESTS AND RESEARCH

Radar Performance Study

A radar performance study utilizing the radar data provided by the FAA revealed that, just before the accident occurred, the airplane flew generally to the southeast for 20 nautical miles before entering a steeply descending, accelerating left turn where portions of the empennage separated from the airplane. The airplane continued on a descending, turning flight path until it crashed about 20 seconds later.

An airplane performance history was developed using the recorded radar data, airplane characteristics, and atmospheric data. The performance history indicated that the airplane had been flying in a generally southerly direction about 6,500 feet altitude and 130 knots indicated airspeed (KCAS) when it entered a nearly inverted attitude, lost about 3500 feet in altitude, accelerated to about 220 KCAS (253 mph), and reversed direction in 10 seconds.

Examination of primary radar returns indicated that pieces of the airplane first began to separate from the airplane at approximately 1651:17 and had separated by 1651:20. Radar data indicated that the airplane however continued to "fly" to the northwest while descending and decelerating and turning south to the accident site.

Examination of data revealed that the most efficient way to achieve the maneuver was to roll nearly inverted and pull 2.5 Gs.

Trajectory Study

A trajectory study also was performed. In the study, two potential breakup scenarios were evaluated.

The first set of conditions was established at the point just before the airplane started into a rapid descent at 1651:08. The airplane was flying level at 6,500 feet msl, tracking about 180 degrees true, and 140 KCAS.

The second set of conditions was generally established at a point in the Radar Performance Study where the airplane would break up and the pieces would fall in the debris field. At that point in the flight path, airplane was descending at a 48-degree flight path angle, through about 4,500 feet msl, 220 KCAS, and tracking 040 degrees true.

The best fit of trajectory data however, was obtained using 220 KCAS and tracking 000 degrees true. This was not surprising, as a radar performance study "flies" an airplane simulator model

through the radar data points and it is recognized that significant maneuvering may occur between the radar points. Thus, a rapid change in flight path before and after the breakup is not an unusual event. The airplane continued to maneuver until it impacted terrain about 1651:40.

The ballistic trajectories of the parts from the second set of conditions were better grouped at the initiation point, thus indicating that the breakup occurred at the lower altitude and higher speed.

The trajectory study also showed that the airplane likely broke up at the lower altitude during a rapid descent and high airspeed, about 220 KCAS. The flight conditions at the breakup were consistent with the Radar Performance Study. The positions of the calculated initiation points were tightly grouped; the range of calculated initiation points was less than 0.2 nm (except for one part). The range of calculated initiation points for the high, cruise type of breakup was about 0.6 nm.

Structures Study

Most of the airplane was found at the main crash site. Major portions of the empennage, including the left horizontal stabilizer, left elevator and tab, vertical stabilizer, rudder, and counter balances were found in a small grouping about 0.6 nautical miles from the main crash site. The left wing tip and canopy were also found in the separate grouping of parts.

The performance and trajectory studies indicated that the airplane broke up at a high speed and low altitude near the grouping of empennage parts that were found separate from the fuselage.

All fractures exhibited characteristics consistent with static overload. No evidence of multiple dynamic loading fractures was found, nor evidence of fatigue characteristics or other preexisting damage.

The damage to the left horizontal stabilizer was also consistent with downloading. The damage to the vertical stabilizer and rudder was consistent with loading to the left (when looking forward).

Service Bulletin (SB) 14-01-31 and SB 14-02-05

Vans Aircraft had issued SB 14-01-31 to address fatigue cracks that had been found in the horizontal stabilizer forward spar area on some airplanes. The cracks were in the radius where the spar web transitions into a flange.

Van's Aircraft had also issued SB 14-02-05 to address cracking near the rivets attaching the nut plates that hold the elevator rod ends to the E-702 Spar and E-610PP or E-611PP Spar Reinforcement Plates.

As part of the investigation, both areas specified in the service bulletins were examined for any preexisting damage.

Examination of the radius where the spar web transitions into a flange did not reveal any evidence of fatigue cracking. The right radius was free of any cracking, either from static overload or fatigue, and the left flange was partially separated from the web with one end of the fracture at the junction of the web and radius. The fracture surface was granular and at 45-degrees to the surface of the web.

Examination of the elevator spar web near the elevator attach points also did not reveal the presence of any cracks near the rivets which attach the nut plates that hold the elevator rod ends.

ADDITIONAL INFORMATION

An interview with a friend of the pilot revealed that the pilot had been up in a Pitts Special with someone a couple of times who had shown him some basic aerobatics. The friend stated that he and the pilot would fly over Atlantic City, in formation and when the pilot would want to do an aerobatic maneuver that he would pull away from him and then do the maneuver.

The friend also stated that he had seen the pilot recover after falling out of a maneuver at low altitude before, and that it was not uncommon for the pilot to sometimes fall out of a maneuver (loop and/or roll). He further added, that knowing the pilot, that there was a possibility that he may have fallen out of an aerobatic maneuver on the accident flight.

Review of a video that was taken during a previous flight from another airplane by his friend revealed that during that flight, a left roll was performed by the pilot. During the maneuver, it was observed that the pilot allowed the nose to drop and that the airplane lost approximately 1,000 feet of altitude.

History of Flight

Maneuvering-aerobatics	Loss of control in flight (Defining event)
Uncontrolled descent	Aircraft structural failure Part(s) separation from AC Collision with terr/obj (non-CFIT)
Post-impact	Fire/smoke (post-impact)

Pilot Information

Certificate:	Private	Age:	43
Airplane Rating(s):	Single-engine Land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	
Instrument Rating(s):	None	Second Pilot Present:	No
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	Class 2 Without Waivers/Limitations	Last FAA Medical Exam:	07/11/2013
Occupational Pilot:	No	Last Flight Review or Equivalent:	
Flight Time:	(Estimated) 400 hours (Total, all aircraft), 85 hours (Last 90 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	BROWN ROBERT K	Registration:	N174BK
Model/Series:	RV7A	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	Yes
Airworthiness Certificate:	Experimental	Serial Number:	70340
Landing Gear Type:	Tricycle	Seats:	2
Date/Type of Last Inspection:	03/15/2013, Condition	Certified Max Gross Wt.:	1900 lbs
Time Since Last Inspection:	45 Hours	Engines:	1 Reciprocating
Airframe Total Time:	455 Hours at time of accident	Engine Manufacturer:	Superior Air Parts
ELT:	C91A installed, activated, did not aid in locating accident	Engine Model/Series:	IO-360-B1AA3
Registered Owner:	On file	Rated Power:	180 hp
Operator:	On file	Operating Certificate(s) Held:	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Day
Observation Facility, Elevation:	ACY, 75 ft msl	Distance from Accident Site:	6 Nautical Miles
Observation Time:	1654 EDT	Direction from Accident Site:	120°
Lowest Cloud Condition:	Clear	Visibility	10 Miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	9 knots /	Turbulence Type Forecast/Actual:	/ None
Wind Direction:	200°	Turbulence Severity Forecast/Actual:	/ N/A
Altimeter Setting:	30.05 inches Hg	Temperature/Dew Point:	22° C / 14° C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Cross Keys, NJ (17N)	Type of Flight Plan Filed:	None
Destination:	Cross Keys, NJ (17N)	Type of Clearance:	None
Departure Time:	1640 EDT	Type of Airspace:	Class G

Wreckage and Impact Information

Crew Injuries:	1 Fatal	Aircraft Damage:	Destroyed
Passenger Injuries:	N/A	Aircraft Fire:	On-Ground
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Fatal	Latitude, Longitude:	39.506389, -74.700556

Administrative Information

Investigator In Charge (IIC):	Todd G Gunther	Report Date:	06/18/2015
Additional Participating Persons:	John Penzone; FAA/FSDO; Philadelphia, PA		
Publish Date:	06/15/2015		
Note:	The NTSB traveled to the scene of this accident.		
Investigation Docket:	http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=88095		

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available [here](#).